



Strategic Risk Assessment

12/1/2009

Team Members



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What was asked for



- From the original ToR:
 - Initially background research and literature reviews will be performed as appropriate to inform the framework development. It is expected that this will involve identification of best practices and lessons learned from the Air Force and other organizations which have implemented enterprise risk management processes, as well as internal best practices.
 - Next, there are two approaches that will be developed in Phase 1 to identify and assess strategic risks. The first approach is a “bottom-up” approach, where risks are collected from existing sources including, but not limited to: budgetary issues across the agency, OCE risk issues, and BPR State of the Agency “Red-Yellow-Green” data collection. The second approach is to identify agency-level risks that do not result from the first approach. This is a “top-down” approach, where these risks would represent those of an institutional and/or non-project/program nature, and may involve risk identification with subject matter experts from PA&E and with the core team members.
 - Finally, a methodology for normalizing and ranking identified strategic risks against each other will be developed.



Approach

- Hired the Aerospace Corporation to assist
 - Work with Strategic Missile Command in risk ranking & tracking
- Performed a literature search on risk management
 - Both internal to NASA and external
- Developed two potential risk frameworks
 - Based on Aerospace experience and literature search
- Built framework to evaluate potential implementation ideas
- Discussed both framework & implementation ideas with ESMD, SOMD, and SMD

What follows: the set of Aerospace final presentation slides (slightly modified for length) followed by a description of the MD reactions)



Selected Slides From Aerospace Final Presentation

Framework for Strategic Risk Assessment

Phase I Final Briefing

The Aerospace Corporation
August 31, 2009

Introduction

- Purpose
 - *Develop and demonstrate a methodology for the comparative assessment of risks across the entire portfolio of NASA projects and assets*
- Assumptions
 - *A “proof of concept”, demonstrating that disparate risks from across different parts of the agency can be compared*
 - *This presentation includes phase 1 only; Demonstration of framework and tool implementation is phase 2, which is TBD*
- What is Strategic Risk?
 - *Working definitions:*
 - “high level, long term risks, especially those that do not belong to a single program, mission area or Center”
 - “a risk for which the potential consequences are not fully comprehended and/or mitigated at the project, Directorate or Center level”
 - *The framework described here is not necessarily fixed to any particular definition or type of risk*

Executive Summary

- Lessons learned from existing framework within NASA and Aerospace/SMC to capture strategic risks
 - *BPR and management councils meetings present cross cutting strategic risks and top directorate risks with no clear ranking*
 - *Aerospace/SMC “Watch List” program utilizes Risk Manager to track risks outside the normal reporting chain*
- Prototype strategic risk framework developed
 - *Proactive “checklist” approach to capture entire spectrum of risks*
 - *5x5 rating (likelihood x consequence) modified to include timeframe*
 - *“Action” ranking for further study or need to involve NASA leadership*
 - *Risk Workbook and database*
- Range of implementation options to choose from
 - *Active Risk Manager – requires new policies and buy-in from Centers*
 - *Passive Risk Advisor – collaborative approach, might better fit NASA’s culture*
 - *Risk Council – least effort required, but easily marginalized*

Identifying, Normalizing and Ranking Strategic Risks

Strategic Risk Identification

Sources

- Internal Sources
 - *Bottom-Up*
 - Risks identified at every level of NASA
 - Risks eventually rise to Strategic level via NPR 8000.4A
 - *Top-Down*
 - Centers
 - Directorates
 - Mission Support Offices
 - Administrator Staff Offices
- External Sources
 - *Government Agencies*
 - Work with other government agencies to identify cross agency strategic risks
 - *DoD, specially Air Force and NRO, is expected to have numerous common risks*
 - Pull from work published by other govt. agencies (e.g. GAO) relating to NASA
 - *Industry*
 - Discuss with industry partners what strategic risks they see in horizon
 - *Academia*
 - Encourage academia to identify and formulate strategic risks
 - *Media*
 - Review journalism, blogs and watchdog materials for strategic risks
 - *Significant challenge in dealing with poor “signal to noise ratio”*
 - *Science Fiction Writers and other innovative means*
 - Risks and opportunities could potentially be identified from fiction writers
 - *Similar to programs using writers to generate terrorist scenarios*

Details will vary depending on specific implementation plan

Normalizing Strategic Risks

Purpose & Approach

- Normalization & Ranking to compare disparate types of Strategic Risks
 - *Global questions to answer for each risk*
 - How serious a risk is this?
 - Allocate resources for further study of risk issue?
 - Bring risk issue to the attention of NASA Leadership?
- Two approaches were considered
 - “Relative”
 - Multiple-choice assessment factors
 - Different assessment criteria → Different consequence rating
 - Reference: A Practical R&D Project-Selection Scoring Tool, Anne DePiante Henriksen and Ann Jensen Traynor, IEEE Trans. on Engineering Management, Vol. 46, No. 2, May 1999
 - “Absolute”
 - Common scale for all risks (e.g., “expected dollar loss”)
 - Approach used in CARMA
- “Relative” normalization and ranking approach was developed to create Ranking Scores

**Developed a quantitative method to score a risk's 1) Relative Risk
2) Value of Further Study and 3) Value of Raising Awareness**

Calculation of Relative Risk Score

Risk: Becomes evident in 2011 that commercial ISS re-supply is not feasible

- Scenario #1 – parameters assigned by a generalist
 - Likelihood, $L = 3$ (roughly even chance)
 - Consequence, $C = 4$
 - Timing, $T = 3$ (since scenario occurs 3 to 5 years in future)
 - Assume $Y = 0.5$ to discount risks in future
- Relative Risk Score
 - $R = 3.22$
- Scenario #2 – parameters assigned by specialists
 - Divided by NASA's strategic goals
 - Consequence:
 - SG1 (retire Shuttle) = 3
 - SG2 (ISS) = 5
 - SG3 (balanced program) = 2
 - SG4 (CEV ASAP) = 2
 - SG5 (commercial partnerships) = 4
 - SG6 (Lunar return & Mars) = 2
 - Assume likelihood and timing remain the same
- Relative Risk Score
 - SG1, $R = 3.00$
 - SG2, $R = 3.41$
 - SG3, $R = 2.71$
 - SG4, $R = 2.71$
 - SG5, $R = 3.22$
 - SG6, $R = 2.71$
 - Overall (equal weighting), $R = 3.00$

www.nasa.gov/pdf/200501main/iss_re-supply_050505

Calculation of Action Ranking Scores

Risk: Becomes evident in 2011 that commercial ISS re-supply is not feasible

- Action rating criteria
 - $U = 3$ (issue pretty well understood)
 - $M = 2$ (mitigation is possible, at added cost)
 - $A = 4$ (NASA leadership involvement required to approve mitigation)
- Action priorities for a single input, based on $R = 3.22$ ($Y, Z = 0.5$)
 - Value of Further Study = 3.34
 - Value of Raising Awareness = 3.02
- Top 5 Action priorities for multiple inputs (split by strategic goals, as in previous chart):

Recommended Action	With Respect To	Ranking
Further study	SG2 (ISS)	3.44
Further study	SG5 (Commercial partnerships)	3.34
Further study	SG1 (Retire Shuttle)	3.22
Raise to attention of leadership	SG2 (ISS)	3.11
Further study	SG4 (CEV ASAP)	3.06

Different risk scenarios are merged and sorted – highest priority actions will rise to the top of the list



Risk Workbook

Workbook Inputs/Outputs

Required Inputs

- Ranking Scores calculated by workbook:
 1. *Relative Risk*
 2. *Value of Further Study*
 3. *Value of Raising Awareness*
- Minimum information required (13 total)
 - *Status (1 Input): Toggle (New, Pending, Closed) – activates/deactivates risk*
 - *Descriptive Inputs (5 Inputs): Title, Description, Level, Category 1, Category 2*
 - *Ranking Parameters (6 Inputs): Timeframe (T), Likelihood (L), Consequence (C), Leadership Involvement Need (A), Mitigation Potential (M), Depth of Risk Understanding (U)*
 - *Point of Contact / Documentation (1 Input)*

***The desired ranking criteria outputs drove minimum inputs needed
As example, Consequence varied as single or multi-step process***

Workbook Inputs/Outputs

Optional Inputs

- Additional descriptive inputs could be included with each risk
 - *Provides more information to decision makers*
 - *Aids in assigning ranking parameters*
- 7 optional descriptive inputs:
 - *Possible mitigation options*
 - *Cost of action*
 - *Risk type (discrete vs. gradient, e.g.)*
 - *Action urgency (lead time)*
 - *Political dimensions*
 - *Public relations effects*
 - *Why is risk enterprise-level?*

Risk Workbook

Results

• Selected values of ranking parameters are transformed into numeric values, on a 1-5 scale
 • If a single person is inputting the ranking parameters, could input these numbers directly

Timeframe of event, T	Likelihood, L	Consequence Rating, C	Leadership Involvement Need (A)	Mitigation Potential (M)	Depth of Risk Understanding (U)	Overall Results		
						Weighted Relative Risk Score	Value of Further Study	Value of Raising Awareness
6	5	2	4	4	2	4.0	3.4	4.0
6	5	2	1	2	5	4.0	3.0	2.4
5	4	2	1	4	3	3.8	2.6	2.7
4	4	2	1	3	4	3.4	2.6	2.4

Implementation Options

Implementation Options

Overview

- Worksheet tool created and implemented will depend on ConOps chosen
- Each risk assessment ConOps can be described by four axes
 1. *Degree of Specialization*
 2. *Ownership of Risk List*
 3. *Sources of Risks*
 4. *Hierarchy*
 - *Each proposed ConOps is described by where it falls on each of those axes*
- Three possible ConOps presented
 - *ConOps #1: Active Risk Manager*
 - *ConOps #2: Passive Risk Advisor*
 - *ConOps #3: Risk Council*
- Many more ConOps possible
 - *Any proposed ConOps can be modified to Leadership needs and desires*

Implementation Options

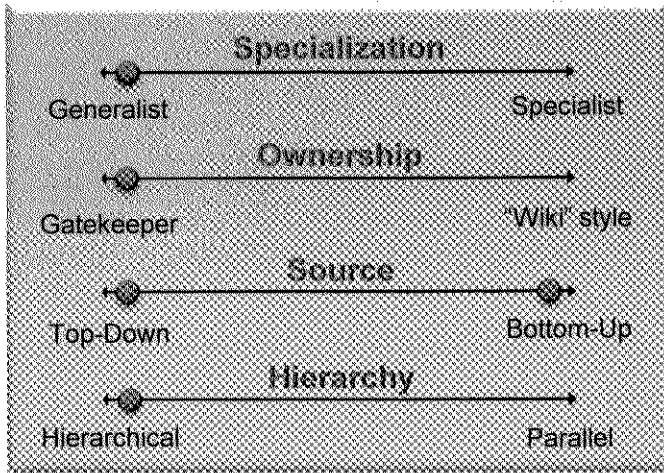
Range of Axes Describing ConOps



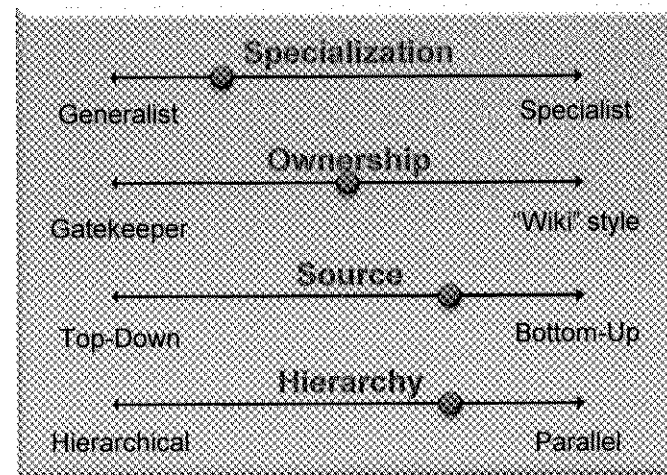
Copyright © 2010 Lockheed Martin Corporation. All rights reserved. Lockheed Martin is a registered trademark of Lockheed Martin Corporation.

Summary of 3 alternative implementation options

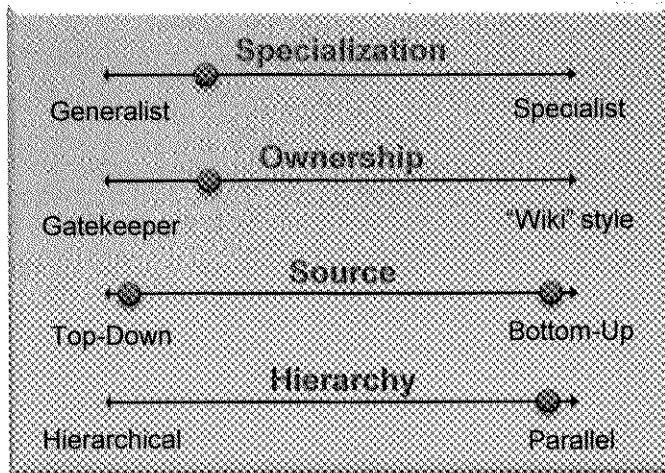
ConOps #1: Active Risk Manager



ConOps #2: Passive Risk Advisor



ConOps #3: Risk Council



ConOps #1: Active Risk Manager

Overview

ConOps Responsibilities

ID – Risk Manager & NASA Entities

(Directorates, Centers, MSO, ASO)

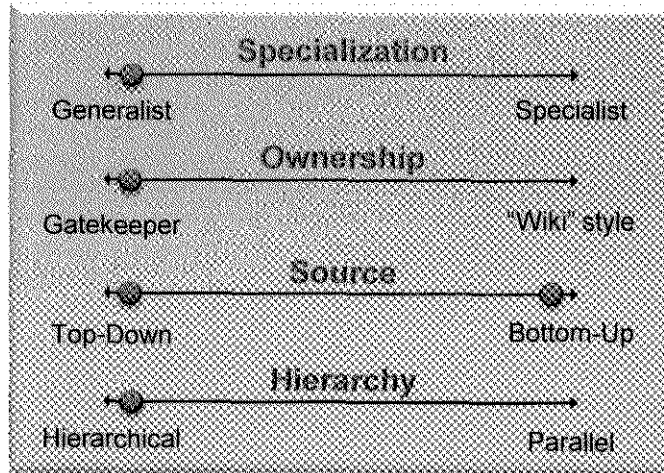
Collect – Risk Manager

(can be fed by NASA Entities)

Evaluate – Risk Manager (can request help)

Manage – Risk Manager

Communicate – NASA Entities to Risk Manager; Risk Manager to NASA Leadership

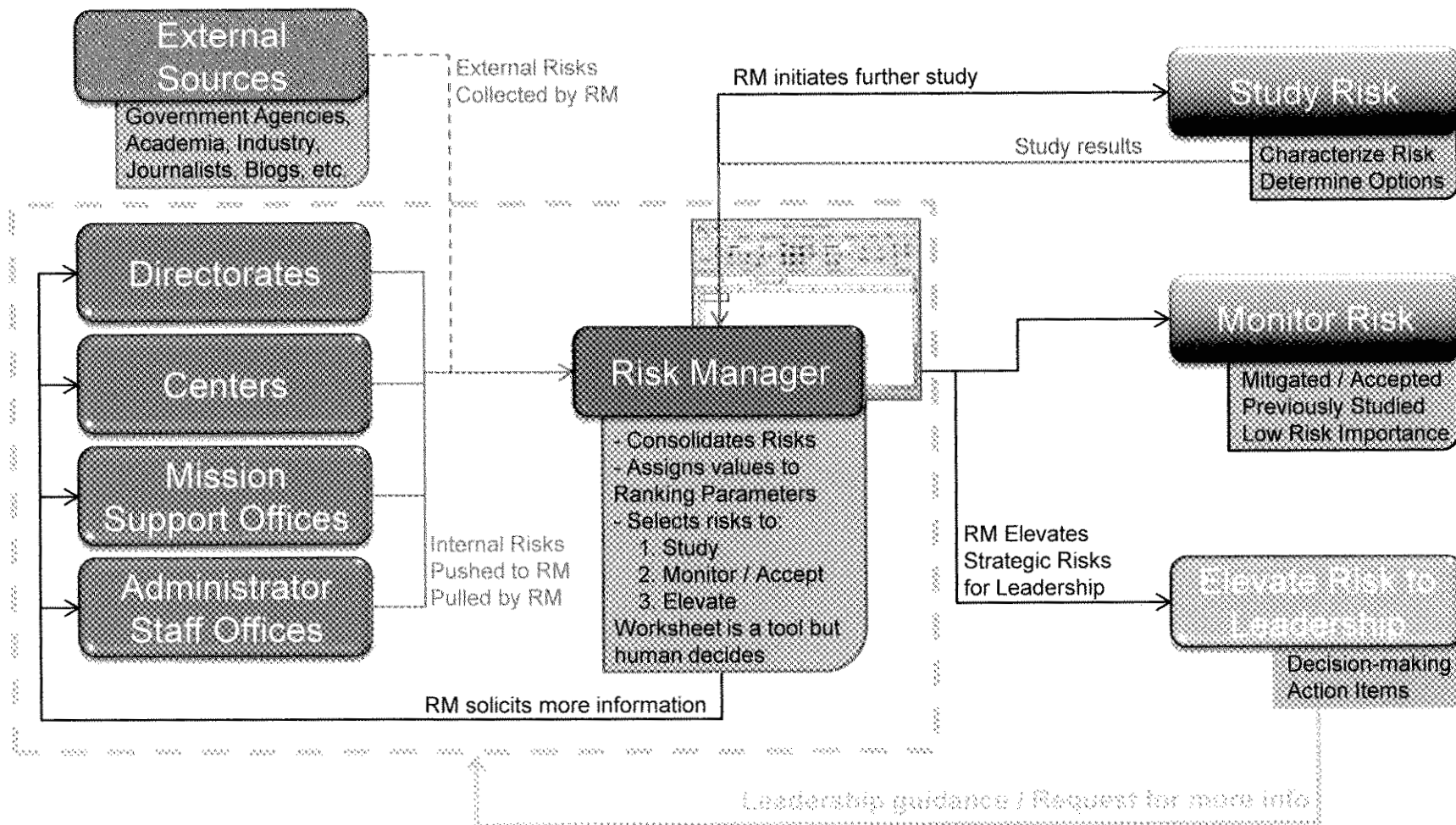


ConOps Description

- Risk Manger (part of PA&E)
 - *All strategic risks pass through RM*
 - Keeps a historical record of all NASA Strategic Risks
 - Actively seeks risks from internal & external sources
 - Iterates with internal sources as needed to clarify risks
 - *Solely responsible for assigning values to Ranking Parameters*
 - *Determines risks to:*
 - Further study
 - Monitor or accept
 - Raise to Leadership (periodically or as needed)
- NASA Entities
 - *Feed internal risks by NASA entities & collects from external sources*

ConOps #1: Active Risk Manager

Flow Chart



Risk Manager responsible for all Strategic Risks & has power to request risks and information from NASA Entities

ConOps #2: Passive Risk Advisor

Overview

ConOps Responsibilities

ID – NASA Entities

Collect – NASA Entities

(for their organization only)

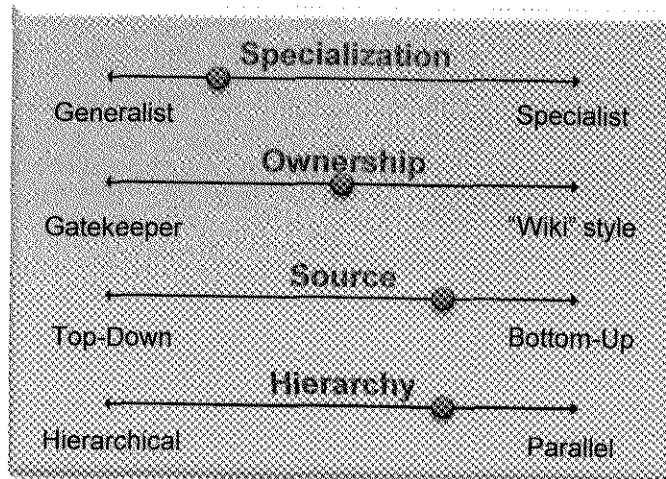
Evaluate – NASA Entities

(may request advise from Risk Advisor)

Manage – NASA Entities

(for their organization only)

Communicate – NASA Entities to NASA Leadership

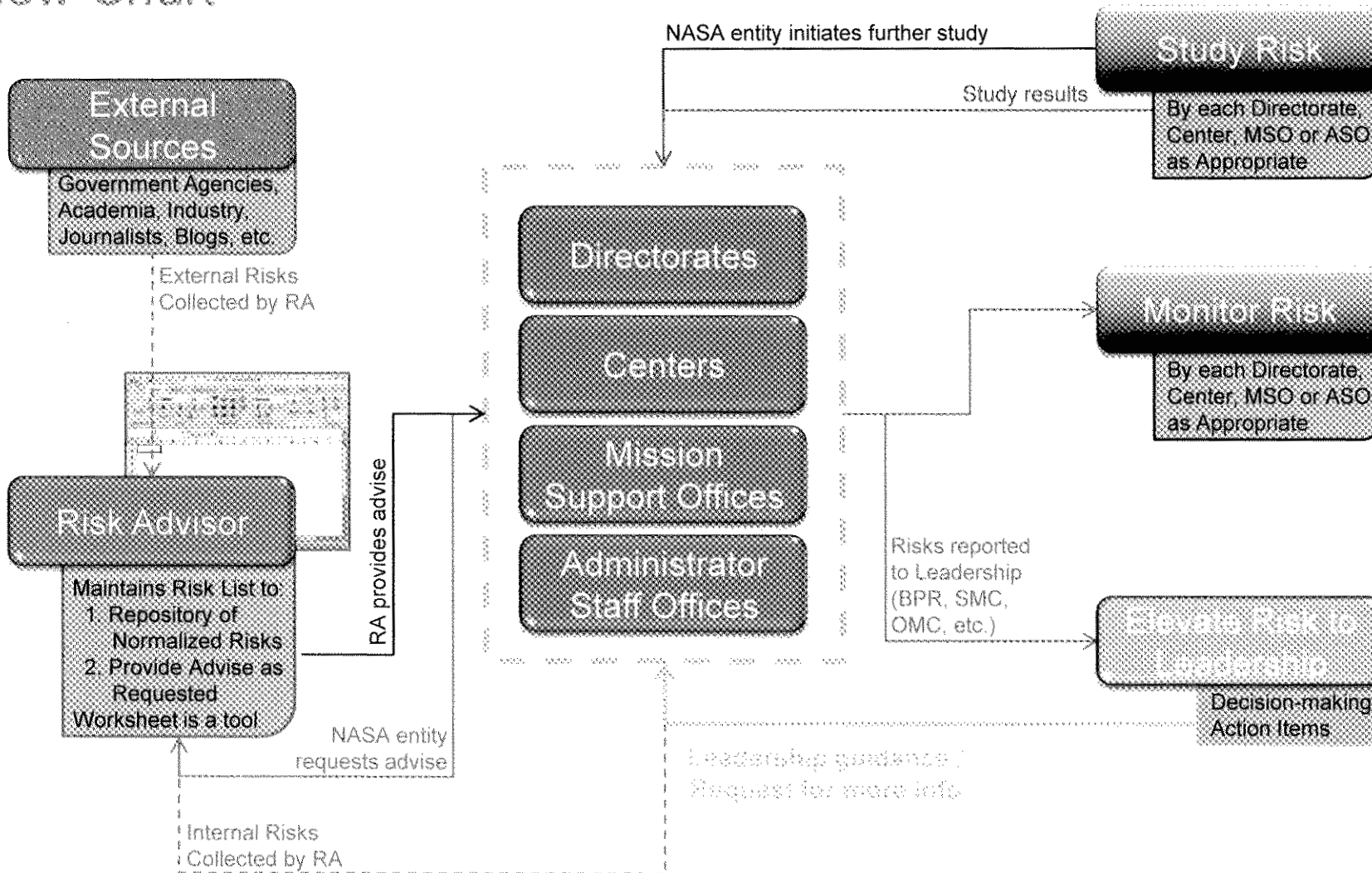


ConOps Description

- NASA Entities
 - Responsible for risks within their own organization only
 - May request advise from Risk Advisor if desired
 - NASA Entities determine risks to:
 - Further study
 - Monitor or accept
 - Raise to Leadership (using current councils)
- Risk Advisor (part of PA&E)
 - Collects risks from whatever sources are available but does not have authority to request them
 - Keeps a list of known risks and uses worksheet to create a ranking to use if services requested
 - Will provide advise to NASA Entities but does not decide what is presented to leadership

ConOps #2: Passive Risk Advisor

Flow Chart



Risk Advisor collects risks from whatever information is already generated by NASA Entities. Advises NASA Entities when solicited.

ConOps #3: Risk Council

Overview

ConOps Responsibilities

ID – Risk Council & NASA Entities

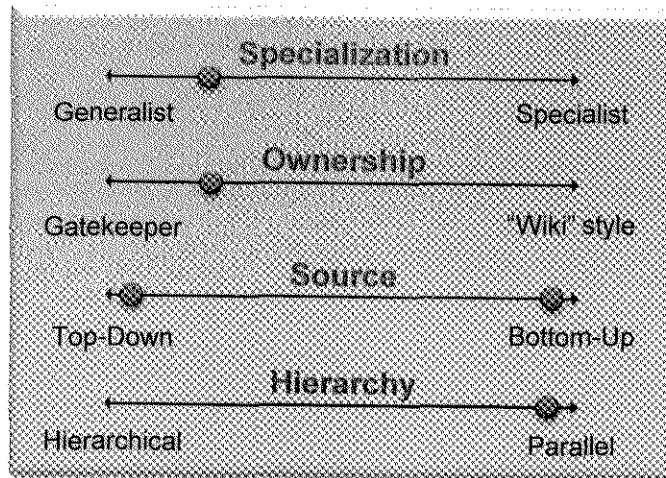
(Directorates, Centers, MSO, ASO)

Collect – Risk Council

Evaluate – Risk Council Members

Manage – Risk Council with Worksheet Admin

Communicate – RC Members provide Ranking Parameter values; WA provides a ranked risk list to Leadership

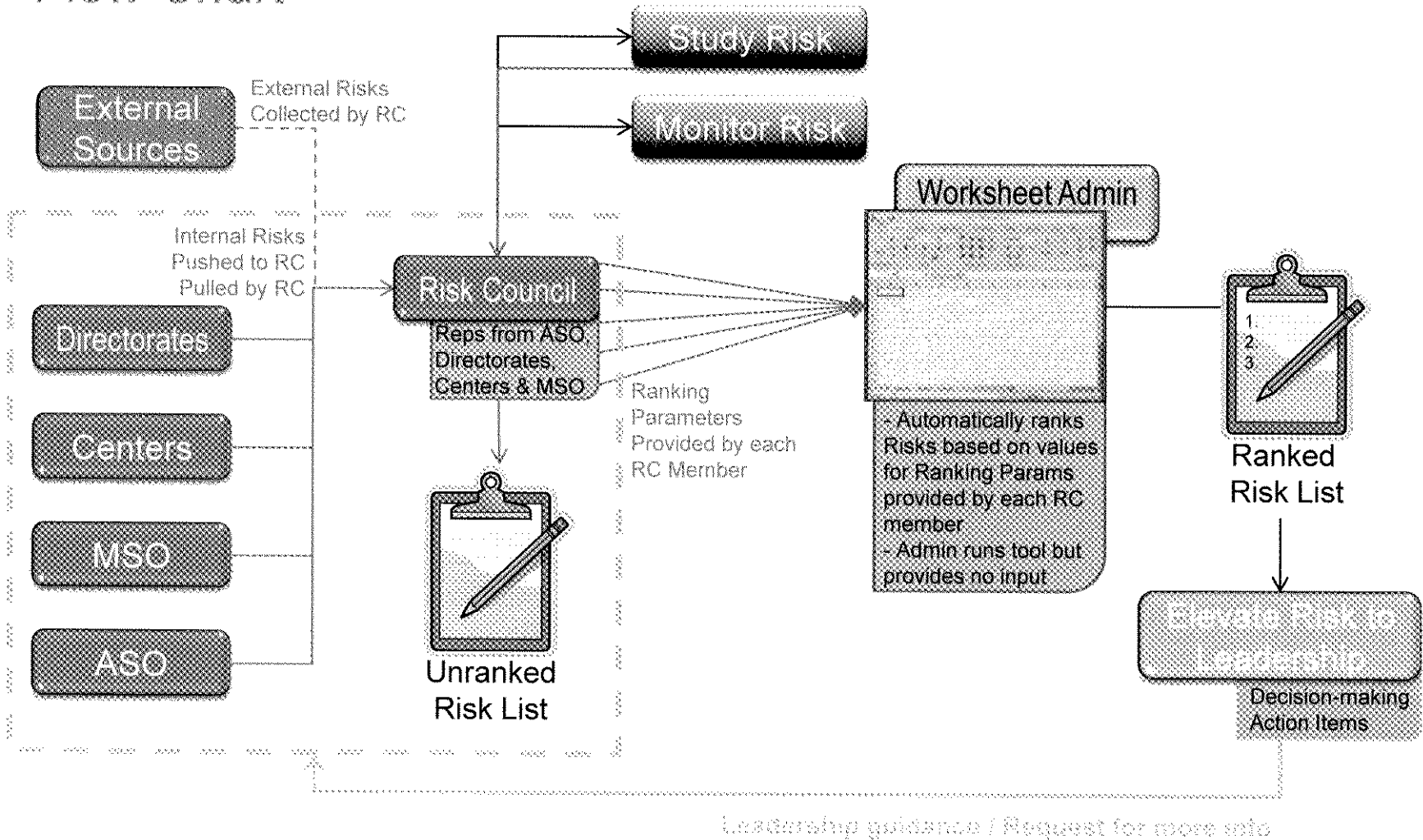


ConOps Description

- Risk Council (reps from NASA Entities)
 - All strategic risks pass through RC
 - Actively seeks risks from internal & external sources
 - Iterates with internal sources as needed to clarify risks
 - Each member is responsible for assigning values of Ranking Parameters to every risk
 - Determines risks to:
 - Further study
 - Monitor or accept
- Worksheet Administrator
 - Keeps a historical record of all NASA Strategic Risks
 - Collects Ranking Parameter values from each RC Member
 - Uses worksheet to automatically rank risks from RC Member inputs
 - Passes ranked risk to Leadership

ConOps #3: Risk Council

Flow Chart



Risk Administrator runs Worksheet for the Risk Council. Worksheet acts as a tool to consolidate inputs from RC Members and auto rank risks.

Other Implementation Considerations

Why Some Risk Issues Should Be Private

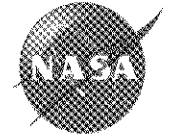
- Budget authorities look for uncommitted funds
 - *If risk suggests delay, then budget might be in play*
- May reveal internal conflict
 - *The Aerospace Watch List sometimes disagrees with program office assessments, which is why it is private*
- May create disincentives
 - *Risk of a schedule slip in a particular subsystem may encourage other managers to “bet on the come” that their parallel project will get schedule relief*
 - *If managers game schedules, what is true Critical Path?*
- May increase risk further
 - *“Pre-emptive” responses by contractor to protect reputation or avoid legal action, for example*
- Mitigation options may be controversial
 - *Workforce impacts might create morale problems, for example*
- Naysayers may blow risk out of proportion
 - *Congress gets its information from the newspapers*

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Mission Directorate Responses

MD Response: ESMD



- ESMD uses Continuous Risk Management
- There is a tremendous amount of work done to formally track ~1400 risks in ESMD
- They added a spot in their framework for a HQ-level risk manager

- However, ESMD was of the opinion that attempting to concatenate any risks across mission directorates would be quite expensive, and using the methodology shown here might make it more so
 - Guess of about \$3M/year to implement

MD Response: SOMD



- SOMD uses a more informal method to track risks
- Each division has a risk manager who reports out at monthly meetings
- Rankings are done at the AA level informally
 - AA attempts to empower AAAs
- SOMD did not see a problem with participating in a Strategic Risk session as long as it was infrequent and not too much of a burden
 - Preferred quarterly meetings of a “Risk Panel” similar to the last implementation framework presented



MD Response: SMD

- SMD uses a more informal method to track risks
- Each division has a risk manager who reports out at monthly meetings
- Rankings are done at the AA level informally
 - AA attempts to empower AAAs
- SMD was resistant to the idea of any sort of risk panel
 - Didn't think it would add value to do infrequently
 - Too much burden to do it frequently
 - Tracking too many risks at mission levels to make an effective meeting
 - Too difficult to concatenate, compare risks across missions, much less across directorates, even less across strategic-mission risks
 - Appears to be HQ micromanagement/mistrust of MDs, centers, projects

Associate Administrator Response



- Presented to Associate Administrator C. Scholese on 12/1/2009
- Generally positively received
- Requested limited implementation of framework in Early 2010
 - Focusing on cross-cutting risks as identified by the monthly NASA Baseline Performance Review

Next Steps



- Implementing a limited set of risks for tracking purposes
 - Will try to capture largest 5-10 risks as presented at the BPR
 - Will attempt quantitative classification if possible
- Determining receiving organization
 - Will involve receiving org in trial run
- Effort required will be assessed
 - Will help calibrate continual use of technique
 - Will help size # of risks to be tracked